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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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04/19/2004

Akihide Shibata

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08/17/2006

BIRCH STEWART KOLASCH & BIRCH

PO BOX 747

FALLS CHURCH, VA 22040-0747

EXAMINER

HO, TU TU V

ART UNIT

PAPER NUMBER

2818

DATE MAILED: 08/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/826,612	Applicant(s) SHIBATA ET AL.	
	Examiner Tu-Tu Ho	Art Unit 2818	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 July 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) 8-11 and 21-24 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7, 12-20 and 25-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 January 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. In view of the Panel Decision from Pre-Appeal Brief Review, paper 20060725, the finality of the rejection of the last office action is withdrawn and prosecution on the merits of this application is reopened.

Election/Restrictions

2. Claims 8-11 and 21-24 are still withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected species, there being still no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on 08/29/2005 and 01/19/2006.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. **Claims 1-7, 12-20, and 25-30** are rejected under 35 U.S.C. §103(a) as being unpatentable over Chan U.S. Patent Application Publication 20030005214 (the '214 reference, cited in a previous office action) in view of Sung et al. U.S. Patent Application Publication 20020130356 (the '356 reference).

Chan in the '214 reference discloses a semiconductor memory device in the background art comprising a nonvolatile memory section and a volatile memory section, but fails to teach limitations as claimed for a nonvolatile memory cell for the nonvolatile memory section.

Referring to **claim 1**, the '214 reference discloses a semiconductor memory device comprising:

a nonvolatile memory section (the Flash memory section of the Flash/SRAM package, paragraphs [0004] to [0006], particularly paragraph [0006]); and

a volatile memory section (the SRAM memory section of the Flash/SRAM package, paragraphs [0004] to [0006], particularly paragraph [0006]), wherein

the nonvolatile memory section includes a nonvolatile memory cell.

However, the '214 reference does not teach that the nonvolatile memory cell includes charge storage areas on both side of a gate electrode of the cell. Specifically, the reference does not teach the nonvolatile memory cell as having a single gate electrode formed on a semiconductor layer via a gate insulating film, a channel region disposed under the single gate electrode, diffusion regions disposed on both sides of the channel region and having a conductive type opposite to that of the channel region, and memory functional units formed on both sides of the single gate electrode and having a function for retaining charges.

Sung in the '356 reference, in disclosing a semiconductor memory device, teaches in Figs. 1a-1f and respective portions of the specification a nonvolatile memory cell including charge storage areas ("polysilicon sidewalls" 15,15, Figs. 1a-1f, paragraphs [0018] and [0010]) on both side of a single gate electrode (generally indicated at that portion of polysilicon word line/control gate 19 that occupies the void 17, paragraph [0019]) of the cell so as to provide a semiconductor device with higher memory density (paragraph [0006]). Specifically, Sung teaches a nonvolatile memory cell having a gate electrode formed on a semiconductor layer (10) via a gate insulating film (11), a channel region (no number) disposed under the gate electrode,

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diffusion regions (14,14, Fig. 1e) disposed on both sides of the channel region and having a conductive type (n, by phosphor ion implantation, paragraph [0018]) opposite to that (p) of the channel region, and memory functional units (15,15) formed on both sides of the gate electrode and having a function for retaining charges (paragraphs [0018] and [0010]) so as to provide a semiconductor device with higher memory density (paragraph [0006]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form a prior art semiconductor memory device, such as one disclosed by the '214 reference, such that a nonvolatile memory cell of the nonvolatile memory section includes charge storage areas on both side of a single gate of the cell. One would have been motivated to make such a change in view of the teachings in Sung that such a change results in a semiconductor device with higher memory density, as detailed above.

Referring to **claim 12**, the '214 reference discloses a semiconductor device comprising:
a semiconductor memory device that comprises:

a nonvolatile memory section (the Flash memory section of the Flash/SRAM package, paragraphs [0004] to [0006], particularly paragraph [0006]);

a volatile memory section (the SRAM memory section of the Flash/SRAM package, paragraphs [0004] to [0006], particularly paragraph [0006]), wherein

the nonvolatile memory section includes a nonvolatile memory cell; and

a logical operation section (such as section 22, Fig. 2, or section 24, Fig. 4) for performing operation processing on the basis of information stored in the semiconductor memory device.

However, the reference does not teach that the nonvolatile memory cell includes charge storage areas on both side of a gate electrode of the cell. Specifically, the reference does not teach that the nonvolatile memory cell having a single gate electrode formed on a semiconductor layer via a gate insulating film, a channel region disposed under the single gate electrode, diffusion regions disposed on both sides of the channel region and having a conductive type opposite to that of the channel region, and memory functional units formed on both sides of the single gate electrode and having a function for retaining charges.

Sung in the '356 reference, in disclosing a semiconductor memory device, teaches in Figs. 1a-1f and respective portions of the specification a nonvolatile memory cell including charge storage areas ("polysilicon sidewalls" 15,15, Figs. 1a-1f, paragraphs [0018] and [0010]) on both side of a single gate electrode (generally indicated at that portion of polysilicon word line/control gate 19 that occupies the void 17, paragraph [0019]) of the cell so as to provide a semiconductor device with higher memory density (paragraph [0006]). Specifically, Sung teaches a nonvolatile memory cell having a gate electrode formed on a semiconductor layer (10) via a gate insulating film (11), a channel region (no number) disposed under the gate electrode, diffusion regions (14,14, Fig. 1e) disposed on both sides of the channel region and having a conductive type (n, by phosphor ion implantation, paragraph [0018]) opposite to that (p) of the channel region, and memory functional units (15,15) formed on both sides of the gate electrode and having a function for retaining charges (paragraphs [0018] and [0010]) so as to provide a semiconductor device with higher memory density (paragraph [0006]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form a prior art semiconductor memory device, such as one disclosed by

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the '214 reference, such that a nonvolatile memory cell of the nonvolatile memory section includes charge storage areas on both side of a single gate of the cell. One would have been motivated to make such a change in view of the teachings in Sung that such a change results in a semiconductor device with higher memory density, as detailed above.

Referring to **claims 13 and 14**, similarly as detailed above for claims 1 and 12, the '214 reference discloses a portable electronic apparatus (paragraph [0008], the first few lines particularly) as claimed and Sung teaches the advantage of the nonvolatile memory cell including charge storage areas on both side of a single gate of the cell.

Referring to **claims 2 and 15**, the '214 reference further discloses that the volatile memory section includes an SRAM, as noted above.

Referring to **claims 3 and 16**, the '214 reference further discloses that the nonvolatile memory cell and the volatile memory cell (a memory cell of the SRAM portion) are formed on a single chip ("same package module", paragraph [0006], "chip" is interpreted broadly), as noted above.

Referring to **claims 6 and 19**, the '214 reference further discloses, as noted above, that:

- a first chip forming the nonvolatile memory section;
- a second chip forming the volatile memory section; and
- a single package containing therein the first chip and the second chip (paragraph [0006]).

Referring to **claims 4 and 17**, the '214 reference further discloses that the volatile memory section (as is known in the art) could include a DRAM (paragraph [0004]).

Referring to **claims 5 and 18**, although both the references do not disclose a refreshing operation means for refreshing the DRAM, a refreshing operation means for refreshing the DRAM is required for the DRAM to function, as is known in the DRAM art.

Referring to **claims 7 and 20**, the '356 reference further teaches that at least a part of the memory functional units (15,15, Fig. 1f) overlaps with a part of the diffusion region (14).

Referring to **claims 25-28**, although both the references do not disclose in details a structure of a memory cell of the volatile memory section (the SRAM part of the Flash/SRAM package), it is known that a SRAM cell at the time the invention was made comprises a transistor having a gate electrode, a gate insulating film, a channel region disposed under the gate electrode and diffusion regions (also known as source/drain regions) disposed on both sides of the channel region. In other words, at the time the invention was made, it is reasonable then to conclude that said volatile memory section, which comprised a transistor, had substantially the same structure as the nonvolatile memory section, which also comprised a transistor as detailed above, as recited in the claims.

However, both the references do not disclose that said volatile memory section has additional extension regions (otherwise known as lightly doped drain regions – or LDD – and in reference to claims 27-28) adjacent to the diffusion regions (also known as source/drain regions) on both sides of the channel region.

Nevertheless, because Applicant has not disclosed in the specification as to any advantage for adding the additional extension regions, said adding of the additional extension regions to the diffusion regions are considered obvious design choices and would be either known or obvious to one of ordinary skill in the art at the time the invention was made.

Referring to **claims 29-30**, the '356 reference further discloses that each memory functional unit (generally indicated at 15) is an insulator film (such as a portion of silicon oxide 11 and/or a portion of ONO 18) having therein a conductor film or a semiconductor layer (polysilicon 15), satisfying the requirement that wherein each memory functional unit is a film having a function of accumulating or trapping charges or a function of holding a charge polarized state, which is an insulator film including a silicon nitride film; an insulator film having therein a conductor film or a semiconductor layer; an insulator film having therein one or more dots made of a conductor or a semiconductor; or a single layer or a lamination layer of an insulator film including a ferroelectric film in which internal charges are polarized by an electric field and its state is held.

Conclusion

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tu-Tu Ho whose telephone number is (571) 272-1778. The examiner can normally be reached on 7:30 am - 6:00 pm, Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Minsun Harvey can be reached on (571) 272-1835. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Tu-Tu Ho
August 12, 2006